

## Effects of Low Activity Solar Cycle on Orbital Debris Lifetime

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Long duration of low solar activity in the last solar minimum has an undesirable consequence of extending the lifetime of orbital debris. The AFRL TacSat-2 satellite decommissioned in 2008 has finally re-entered into the atmosphere on February 5th after more than one year overdue. Concerning its demise we have monitored its orbital decay and monthly forecasted Tacsat-2 re-entry since September 2010 by using the Orbital Element Prediction (OEP) model developed by the AFRL Orbital Drag Environment program. The model combines estimates of future solar activity with neutral density models, drag coefficient models, and an orbit propagator to predict satellite lifetime. We run the OEP model with solar indices forecast by the NASA Marshall Solar Activity Future Estimation model, and neutral density forecast by the MSIS-00 neutral density model. Based on the two line elements in 2010 up to mid September, we estimated at a 50% confidence level TacSat-2's re-entry time to be in early February 2011, which turned out to be in good agreement with Tacsat-2's actual re-entry date. The potential space weather effects of the coming low activity solar cycle on satellite lifetime and orbital debris population are examined. The NASA long-term orbital debris evolutionary model, LEGEND, is used to quantify the effects of solar flux on the orbital debris population in the 200 – 600 km altitude environment. The results are discussed for developing satellite orbital drag application product.